The change in diastolic blood pressure during autonomic blockade is associated with T50 and error signal in young and older women

A.B. Peinado[1,2], E.C. Hart[3], N. Charkoudian[4], M.J. Joyner[2] and J.N. Barnes[2]

[1]Department of Health and Human Performance, Technical University of Madrid, Madrid, Spain, [2]Department of Anesthesiology, Mayo Clinic, Rochester, MN, USA, [3]Department of Physiology and Pharmacology, University of Bristol, Bristol, UK and [4]Thermal and Mountain Division, U.S. Army Research Institute of Environmental Medicine, Natick, MA, USA

Background: Understanding age-related changes in blood pressure regulation is key to preventing and treating hypertension. The blood pressure error signal represents the difference between resting diastolic blood pressure (DBP) and the T50 value, the DBP at which 50% of cardiac cycles are associated with bursts of muscle sympathetic nerve activity (MSNA). We have previously shown that both the T50 and the error signal are different between young men and women, suggesting that sex hormones may have an important influence. The purpose of the present study was to evaluate whether T50 and the error signal relate to the extent of change in blood pressure during autonomic blockade (AB) in young and postmenopausal women. Methods: In 12 young women (YW; 25 ± 1 yrs) and 12 postmenopausal women (PM; 61 ± 2 yrs), we measured MSNA using microneurography, and intra-arterial brachial blood pressure before and during complete AB with trimethaphan camsylate. Relationships between MSNA, T50, error signal (T50-DBP) and ΔDBP with AB were measured using linear regression analysis and Pearson's correlation coefficient. For mean data comparison between YW and PM an unpaired t test was used. Results: ΔDBP was associated with baseline T50 ($r=-0.739$, $p<0.001$), indicating that a greater reduction in DBP during AB was associated with higher T50 values in PM women (74.4±7.6 mmHg; $r=-0.725$, $p=0.008$) but not in young women (65.7±5.1 mmHg; $r=-0.337$, $p=0.285$). There was also an inverse relationship between ΔDBP and the error signal, but only when all women are grouped together ($r=-0.715$, $p<0.001$). This means that women who operate at a higher BP than their T50 (i.e. a negative error signal) have a smaller change in DBP when autonomic tone is removed. Women with the most negative error signal (DBP much higher than T50) had the lowest average MSNA ($r=0.910$, $p<0.001$) in both groups (YW: $r=0.886$, $p<0.001$; PM: $r=0.870$, $p<0.001$). Young women had more negative error signals than PM women (-7.6±5.2 versus 2.1±4.6 mmHg, $p<0.001$; respectively), and lower average MSNA (15.5±4.9 versus 32.9±10.2 bursts/min, $p<0.001$; respectively). Conclusions: Using T50 and error signal analysis, we have identified important differences in control of MSNA between young and PM women. Postmenopausal women had higher T50 values, more positive error signals, and greater drops in DBP during autonomic blockade. These data are consistent with recent reports from our laboratory regarding greater autonomic support of blood pressure in PM women, and provide further evidence of the importance of reproductive hormone influences on sympathetic mechanisms controlling blood pressure in women.

Where applicable, the authors confirm that the experiments described here conform with The Physiological Society ethical requirements.